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original spot of standing (Fig. 14.3) occurs with horizontal adduction as the pectoralis major, coracobrachialis, and the anterior deltoid muscles contract concentrically. The wrist is positioned in slight extension by the cocontraction of the wrist flexor and extensor muscles (extensor carpi radialis longus and brevis, extensor carpi ulnaris, and flexor carpi radialis and ulnaris). Fingers maintain their cylinder grasp on the sandpaper block with flexion and adduction of the flexor digitorum superficialis and profundus and the interossei muscles. The thumb maintains its grasp via contraction of the flexor pollicis longus and brevis and adductor pollicis.

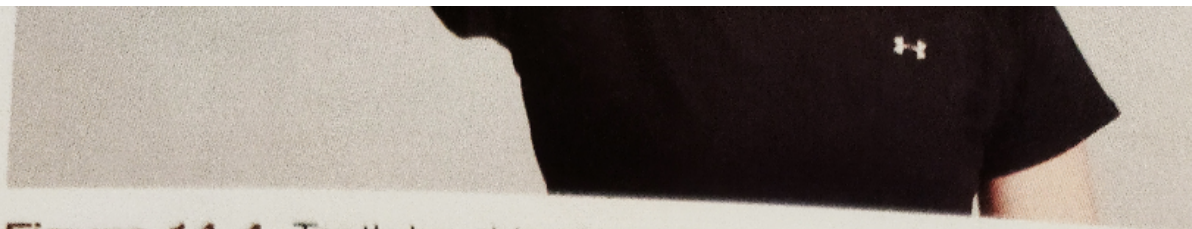
### **Hygiene Activity: Oral Care**

Activities of daily living (ADL) certainly include hygiene. The routine of morning and evening hygiene typically consists of brushing one's teeth (Fig. 14.4). Since this is an activity all individuals perform, it is analyzed here as an example of a typical ADL.

### **Sequence of Movement**

Once the trunk and scapula are stabilized, the shoulder is elevated so the glenohumeral joint is at about  $80^\circ$  of





**Figure 14.4** Tooth brushing is an activity of daily living we all perform. The activity is much more complicated than it appears and requires cooperative movements of all upper extremity joints.

elevation, close to the scapular plane. The elbow is then flexed by the biceps to bring the toothbrush to the mouth, and the forearm is pronated to place the toothbrush on the teeth. Once the toothbrush is properly positioned, small motions of the entire upper extremity's joints provide the tooth brushing activity; the elbow, wrist, and hand grip muscles along with the shoulder complex muscles make small adjustments as the toothbrush is moved to various parts of the mouth and the toothbrush is oscillated over the teeth to clean them.

### Joint Motion

This activity of daily living uses a great deal of glenohumeral joint motion, namely flexion, abduction, horizontal abduction, and horizontal adduction. Scapular rotation with protraction and retraction accompany these glenohumeral motions. The elbow slightly flexes and extends. The forearm maintains pronation, but the wrist alternates between small radial and ulnar deviation movements with slight flexion and extension while brushing the teeth.

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### Muscle Activity

This relatively "simple" activity requires a lot of muscles working cooperatively to produce the desired results. Once again, trunk muscles stabilize the trunk as the upper extremity performs the task. The scapula muscles have more than one function: The upward rotators (upper and lower trapezius and serratus anterior) position the scapula in some upward rotation and then act as stabilizers to maintain the scapular position during the tooth brushing activity. The scapular protractors (serratus anterior and pectoralis minor) and the scapular retractors (rhomboids and middle trapezius) work concentrically in conjunction with the glenohumeral horizontal adductors (pectoralis major, anterior deltoid, and coracobrachialis) and the horizontal abductor (posterior deltoid), respectively. Maintaining the arm in an elevated position throughout the activity requires continual effort of the deltoid and rotator cuff working as a force couple at the glenohumeral joint to hold this position of glenohumeral abduction and elevation. Since elbow motion occurs as the forearm and arm maintain a horizontal alignment to the ground at shoulder level, the small amount of elbow flexion is controlled by concentric activity of the brachialis and biceps brachii and elbow extension results from triceps concentric contraction. The hand assumes a modified hook grasp of the toothbrush with a lateral pinch to control the stability of the toothbrush. The teeth are brushed by back and forth motions coming from contractions of agonist and antagonist muscles controlling glenohumeral horizontal abduction and adduction with scapular retraction and protraction. Short excursions of the elbow occur during the activity in flexion and extension; these motions are controlled by alternating contractions of the elbow flexors and extensors. Although motions are small, wrist flexors and extensors along with radial and ulnar flexors play a very important role in the positioning of the toothbrush and angling it to reach all of the teeth.

### Activities Movement

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### Feeding

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### Sequence

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### Joint Motion

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position the hand relative to the body, either closer to or farther away from it. Two of these functional activities which position the hand for use are presented here.

### Feeding

Feeding is an activity that requires synchronization of several upper extremity joint motions including shoulder flexion, elbow flexion, and forearm supination.<sup>7</sup> Utensils used in eating require primarily stabilization activities of the shoulder, wrist, and hand, whereas the elbow is the joint which moves the most (Fig. 14.5A, B). Its muscles are responsible for controlling the amount and direction of motion and the amount of force required to complete the task successfully.

### Sequence of Movement

As in most other functional activities, stabilizing muscles contract immediately when the motion begins. Therefore, the scapular and glenohumeral stabilizers contract when the finger flexors grasp the spoon or fork. The forearm pronates to pick up the food (Fig. 14.5A), and then there is a simultaneous movement of the forearm into supination and the elbow into flexion as the food is brought toward the mouth (Fig. 14.5B). If any elevation of the shoulder is required, it is during this part of the activity that it occurs to assist in moving the utensil to the mouth. The motions occur in reverse order when the individual returns the fork or spoon to the plate or bowl for more food.

### Joint Motion

Feeding oneself is an activity that requires considerable range of motion at the elbow joint.<sup>1</sup> The act of bringing the hand to the mouth requires that a person maintain the appropriate grasp on the utensil. The grasp used is typically a three-jaw chuck grasp using the thumb, index, and middle fingers (Fig. 14.5A). The elbow flexes to bring the hand to the mouth for food consumption. The elbow moves towards extension but requires the elbow to move to approximately 30° of flexion when the individual returns the utensil to pick up another bite of food from the plate. During this elbow excursion, subtle hand and utensil positioning is often required to reach the food or keep a spoon level when delivering soup to the mouth. These movements typically include



**Figure 14.5** A) The three-jaw chuck grasp. B) The forearm supinates to move the food to the mouth.

some forearm pronation to pick up the food and forearm supination to move the food to the mouth. The scapular plane slightly rotates during the activity.

### Muscle Activity

Scapular and glenohumeral stability of the shoulder is maintained through isometric contraction of the rotator cuff muscles. These include the upward (trapezius) and downward (rhomboid and latissimus dorsi) rotators which include the rotator cuff muscles. The humeral head in the shoulder joint is stabilized by the large muscles to the shoulder. As the spoon approaches the mouth, if additional flexion is needed, the anterior deltoid muscle activates concentrically; the posterior deltoid muscle activates eccentrically to lower the arm. As the utensil is used to pick up more food, the biceps brachii and brachialis muscles



**Figure 14.5** A) The most common grasp for eating is a three-jaw chuck grasp. B) As the elbow flexes, the forearm supinates to move the food to the mouth.

some forearm pronation in positioning the hand to pick up the food and forearm supination to bring the utensil to the mouth. The shoulder is usually maintained in a scapular plane slightly away from the body throughout the activity.

### Muscle Activity

Scapular and glenohumeral stabilizers provide for proximal stability of the extremity during elbow motions through isometric contractions. Scapular stabilizers include the upward (trapezius and serratus anterior) and downward (rhomboids, levator scapulae, and pectoralis minor) rotators whereas the glenohumeral stabilizers include the rotator cuff and deltoid, which maintain the humeral head in the fossa. There may be minimal activity of the large muscles to elevate the arm when the fork or spoon approaches the mouth. If this glenohumeral elevation is needed, the anterior deltoid and pectoralis major activate concentrically; these same muscles work eccentrically to lower the arm as the individual returns for more food. As the utensil is brought to the mouth, the biceps brachii and brachialis control the elbow flexion



## 624 FUNCTIONAL ACTIVITIES

concentrically. When the utensil is returned to the plate or bowl, the same elbow flexors contract eccentrically, controlling the speed and direction of elbow extension against gravity. Moving the fork or spoon to the mouth requires a concentric contraction of the supinator and biceps brachii supinating to rotate the forearm anteriorly to keep the utensil in an upright position so the food does not fall off before it gets to the mouth. Rotating the forearm into pronation as the utensil is returned to the plate or bowl for more food, such as soup, occurs with an eccentric contraction of these same muscles. Isometric contraction of wrist flexors (flexor carpi radialis and ulnaris) and wrist extensors (extensor carpi radialis longus and brevis and extensor carpi ulnaris) provide cocontraction to maintain wrist stability during the activity. As the utensil is brought to the mouth, slight radial deviation occurs through concentric activity of the flexor carpi radialis and extensor carpi radialis longus. The finger and thumb flexors (flexor digitorum superficialis and profundus and flexor pollicis longus) with slight

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## Combing

forward flexion followed by  
supination pronation of forearm  
and grasping the comb.  
after that the shoulder goes  
into extension followed by  
abduction and elbow flexion  
and wrist is in extension and  
radial deviation.

during the combing shoulder  
joint goes into external  
rotation and scapula goes  
in protraction and retraction.

muscle action :- scapular and  
shoulder stabilizers

provide stability.

~~Scapular~~ Scapular stabilizers -  
trapezius and serratus anterior  
rhomboids, levator scapulae  
pectoralis minor

GH stabilizers are Rotator cuff  
and deltoid

- Biceps brachii and brachialis control the elbow flexion
- the scapular protractors serratus anterior and pectoralis



one surface to standing or sitting upon another surface. There are many different types of transfer tasks. The specific method of transfer is determined by the nature of the task.

Sit-to-Stand from a Seated Position

Date : / /

No. (Date)

minor and scapular retractors  
rhomboids and middle trapezius  
work concentrically in conjunction  
with the arm abductors

wrist extensors like ECRB, ECR, ECU  
are responsible for wrist  
extension movement.